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DRAWINGS ATTACHED

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1 316 108

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(19)

(54) IMPROVEMENTS RELATING TO APPARATUS FOR TESTING PRINTED CIRCUIT BOARDS

(71) We, BRITISH AIRCRAFT CORPORATION LIMITED, a British Company, of 100 Pall Mall, London S.W.1, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to apparatus for testing printed circuit boards.

For fast testing of printed circuit boards it is desirable to use an automatic test equipment, that is to say an equipment which by means of tape control is capable of applying a predetermined series of electrical tests to a circuit board. This is usually possible for testing circuit boards which are provided with a plug and socket type of electrical connection although even with boards which have such a connection it is often necessary to make extra connections, e.g. by applying probes to selected points on the board in order to obtain adequate diagnostic information. In some cases, it is necessary to make such extra connections for certain tests and to remove those connections whilst carrying out other tests because then redundant connections may cause false operation of the circuit due to stray effects. Many printed circuit boards do not have a plug and socket type of electrical connection in which case all the connections for testing purposes may have to be made by applying probes.

According to the present invention, an apparatus for testing printed circuit boards comprises a jig for locating a printed circuit board relative to a member carrying at least two extensible and retractable probes each of which, when extended, makes contact with a corresponding portion of the printed circuit board, means for extending selected probes, and an electrical connection to each of the probes from an associated terminal external to the member for applying an electrical potential to the portions of printed circuit board contacted by the probes when so extended.

In one preferred arrangement, the member which carries the probes comprises a block formed with bores extending through it in which the probes are housed.

The block is preferably of electrically insulating material.

In another arrangement in which the block which carries the probes is not of electrically-insulating material, the boreholes extending through it are lined with electrically insulating material.

In one construction of the invention, the probes are each provided with enlarged portions which act as pistons slidable within the boreholes. The pistons are preferably of electrically insulating material.

The means for extending the probes may be actuated by pneumatic or hydraulic pressure or by vacuum, or may be spring-actuated.

Each probe may include a buffer circuit so that a printed circuit may be tested without injection of a spurious signal.

One form of the invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a perspective circuit board test apparatus incorporating several test probes,

Figure 2 is a sectional view of part of the apparatus of Figure 1 showing two of the probes mounted in the block, and

Figure 3 is a perspective view of a programme plate device for selecting the probes which are to be extended and which may be used optionally with the apparatus of Figure 1 and 2.

In the embodiment of Figure 1 and 2 a block of electrically insulating material is formed with twelve throughbores 2 each of which is shouldered at 3 and 4. Within each bore 2 is mounted a piston rod 5

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which has a pointed lower end and carries a piston 6, the rod 5 being made of electrically conductive material but the piston 6 being of insulating material. The piston 6 is a close sliding fit in the largest diameter of the bore 2. Upward movement of the piston 6 is limited by the shoulder 3, whilst downward movement of the piston is limited by a cover plate 7 which is bored to form a seal with the piston rod 5. A peripheral rim 8 depends from the cover plate 7 and is of such a depth that when a piston rod 5 is in its uppermost position the lower pointed end of the piston rod lies above the bottom edge of the rim. The chambers 10 formed in the bores 2 between the piston 6 and the cover plate 7 are all interconnected by passages 11 which have a common inlet 12 permanently connected to a source of compressed air (not shown), so that the pistons 6 are normally raised by the air pressure in the chambers 2 acting on their undersides and lie in their upper, retracted positions against the shoulders 3.

The upper end of each bore 2 is provided with a bush 15 of electrically conductive material. A coiled conductor 16 is soldered at its ends respectively to the bush 15 and the piston rod 5 to provide an electrical path between the bush and the piston rod. An annular flange 17 extends from the bush 15 and acts as a convenient place to solder one end of an electric lead 18, the other end of which is connected to the automatic test equipment (not shown). Each bush 15 also acts as a connection for one end of a flexible pipe 19 connected to the compressed air source, through a selector valve (not shown) which is controlled by the automatic test equipment. The selector valve is operable to connect the compressed air source to the upper parts of one or more selected bores 2 via the respective pipes 19 and bushes 15, for the purpose of extending the corresponding selected probes.

The apparatus includes a jig 20 which comprises a base plate 21 from which project a number of dowel pins 22 for locating a printed circuit board 23 and the block 1; these parts are clamped together. In use, the automatic test equipment referred to will actuate the selector valve to cause compressed air to enter the upper parts of the bores 2 of the selected probe units through the connection 19 and bushes 15. Since the effective piston area above the piston 6 in each bore 2 is greater than that below the piston, the air pressure above the piston 6 of each selected probe will overcome the thrust of the air pressure in the chamber 10 below the piston of that probe and will cause the selected probe to extend and make contact with the printed circuit. An electrical potential is thereby applied to the selected points in the printed circuit engaged by the extension of the selected probes, and the automatic test equipment examines the circuit accordingly. After a test the upper parts of the bores 2 of the selected probe units are vented to the atmosphere through the selector valve, whereupon the compressed air in the lower chambers 10 will retract the probes into their upper positions.

Various combinations of probes may be selected by the test equipment and extended in a series of tests upon a printed circuit board.

Probes of the type described are particularly suitable for testing printed circuits on which blobs of solder etc. may require the probes to be extended to different lengths.

If required, a probe may incorporate a buffer circuit to ensure that a printed circuit may be tested without injection of a spurious signal.

It is not essential to provide an automatic test equipment to control the probes, and a number of other ways of controlling them may be used, for example manual selection.

It will be appreciated that different methods of probe extension and retraction may be employed. For example, each probe may be retracted by means of a return spring or by means of a vacuum applied to the upper chambers, instead of by a bias pressure acting on the under side of the piston. Again, the means for extending the selected probes may be spring-actuated.

Figure 3 shows a modification which can be employed optionally instead of the selector valve, to select the particular pattern of probes which are to be extended into engagement with the printed circuit. In this case, all the flexible pipes 19 which lead to the individual bores 2 containing the probes, are connected at their upstream ends to individual bores 30 in a slide block 31. A programme plate 32 can be slid into a recess 33 in the slide block 31 to overlie the upper ends of the bores 30. The programme plate 32 is formed with a pattern of holes 34 which when the plate is inserted will lie in register with the bores 30 associated with certain of the probes which are required to be extended, whilst the unperforated parts of the plate cover and close the remaining bores 30. A cover block 35 formed with a recess in its under side is secured to the top of the slide block 31, defining a chamber above the programme plate, and a single flexible pipe 36 connected at its far end through a simple on/off valve to a supply of compressed air leads through the cover block 35 and into the chamber.

Thus when compressed air is supplied

to the chamber by the opening of the air valve, the programme plate 32 ensures that the air pressure in the chamber is transmitted only to certain of the probes which are required to be extended, according to the pattern of holes 34 in the programme plate. The selected probes will therefore be extended by the air pressure leaving the remaining probes retracted.

By replacement of the slide plate 32 with another having a different pattern of holes 34, a different pattern of probes to be extended can be selected.

WHAT WE CLAIM IS:—

1. An apparatus for testing printed circuit boards comprising a jig for locating a printed circuit board relative to a member carrying at least two extensible and retractable probes each of which, when extended, makes contact with a corresponding portion of the printed circuit board, means for extending selected probes, and an electrical connection to each of the probes from an associated terminal external to the member for applying an electrical potential to the portions of the printed circuit board contacted by the selected probes when so extended.

2. An apparatus for testing printed circuit boards as claimed in Claim 1 wherein the member which carries the probes comprises a block formed with bores extending through it in which the probes are housed.

3. An apparatus for testing printed circuit boards as claimed in Claim 2 wherein the block is of electrically insulating material.

4. An apparatus for testing printed circuit boards as claimed in Claim 2 wherein the bores extending through the block are lined with electrically insulating material.

5. An apparatus for testing printed circuit boards as claimed in any of Claims 2 to 4 wherein the probes are each provided with enlarged piston portions cooperating with close-fitting cylinder bores in the block.

6. An apparatus for testing printed circuit boards as claimed in any of the preceding claims wherein the means for extending the selected probes comprises a pneumatic or hydraulic system, or is spring-actuated.

7. An apparatus for testing printed circuit boards as claimed in any of claims 1 to 5 wherein the means for extending the selected probes is pneumatic or hydraulic, and in which the probes are provided with return springs for retracting them.

8. An apparatus for testing printed circuit boards substantially as described herein with reference to the Figures 1 and 2 of the accompanying drawings, with or without the modification of Figure 3.

KILBURN & STRODE,
Chartered Patent Agents,
Agents for the Applicants.

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1315108 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

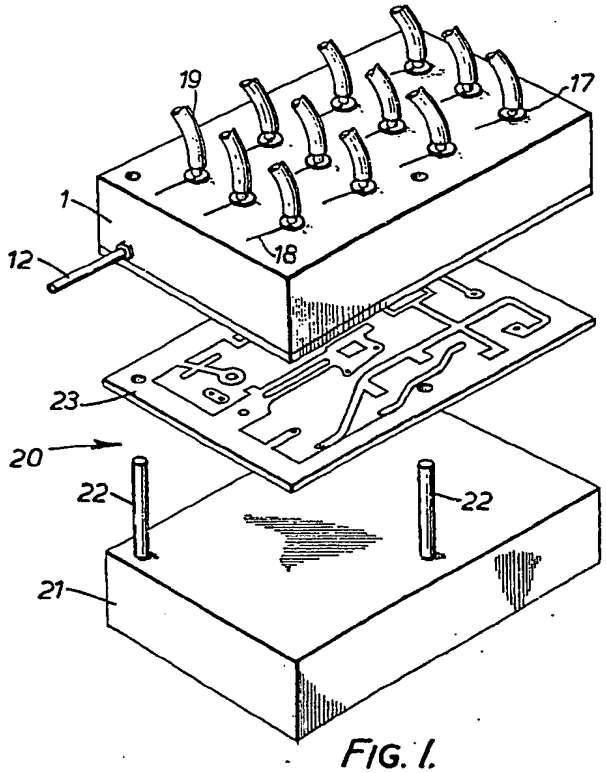

FIG. 1.

1316108 COMPLETE SPECIFICATION
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Sheet 2

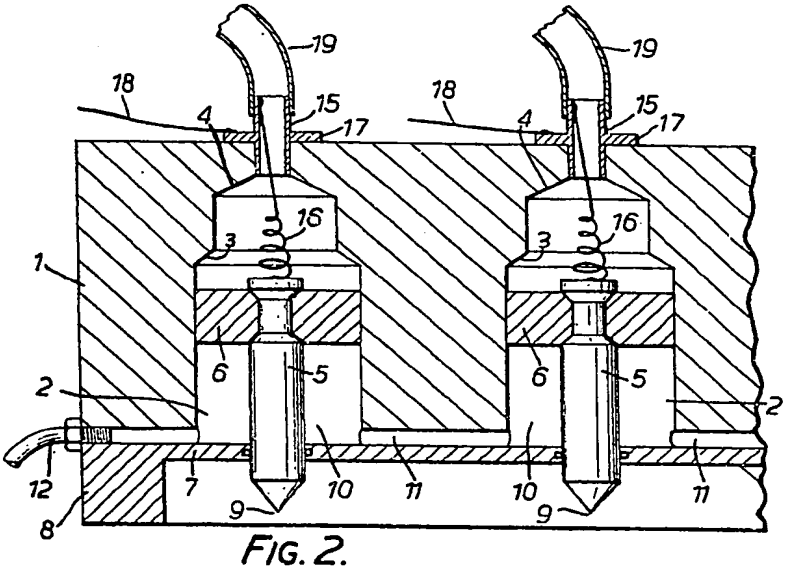

FIG. 2.

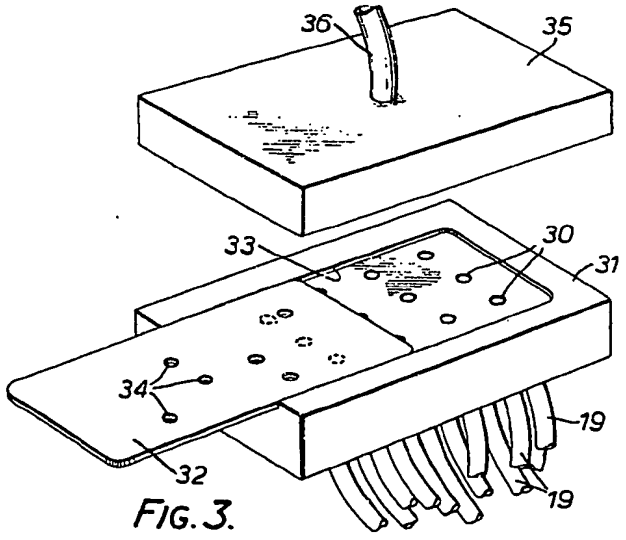

FIG. 3.